

97 cherokee  
pilot Bearing Specs  
For 4.2L crank

1.052-1.056 OD, .75 ID, .75-.81

# Jeep

## AX 15 MANUAL TRANSMISSION SERVICE MANUAL SUPPLEMENT

### 1989 JEEP VEHICLES

To order the special service tools used and illustrated,  
please refer to the instructions on inside back cover.



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## Foreword

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operation. Information in this manual is divided into sections.

These sections contain general information, diagnosis, testing, removal and installation, assembly and disassembly procedures for the components. The diagnosis charts are designed to help you locate and correct problems with a systematic approach.

The information descriptions, testing procedures and specifications were in effect at the time this manual was released for printing.

Chrysler Motors reserves the right to change testing procedures, specifications, diagnosis, or repair methods at any time without prior notice or incurring obligation.

Information describing the operation and use of standard and optional equipment is included in the Operating Instructions and Product Information manual located in the glove box.

NOTE: FOR INFORMATION NOT COVERED IN THIS MANUAL REFER TO . . . "ENGINE, CHASSIS & BODY SERVICE MANUAL" OR "ELECTRICAL MANUAL" FOR 1989 JEEP VEHICLES.

# AX 15 MANUAL TRANSMISSION

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## GENERAL SERVICE INFORMATION

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## DESCRIPTION AND APPLICATION

### Description

The AX 15 is a high capacity, five speed, synchromesh, manual transmission. Fifth gear is an overdrive range with a ratio of .789:1. The shift mechanism is integral and mounted in the shift tower portion of the adapter housing (Fig. 1).

An adaptor housing is used to attach the transmission to the transfer case on 4-wheel drive models. A standard extension housing is used on 2-wheel drive models.

### Application

The AX 15 is used in Cherokee/Wagoneer/Comanch models with the 4.0L, I-6 engine and in Wrangler/Y models with the 4.2L, I-6 engine. The AX 15 is designed for use with either two-wheel drive or four-wheel drive powertrain systems.

## TRANSMISSION IDENTIFICATION

The AX-15 identification code numbers are on the bottom surface of the transmission gear case (Fig. 2).

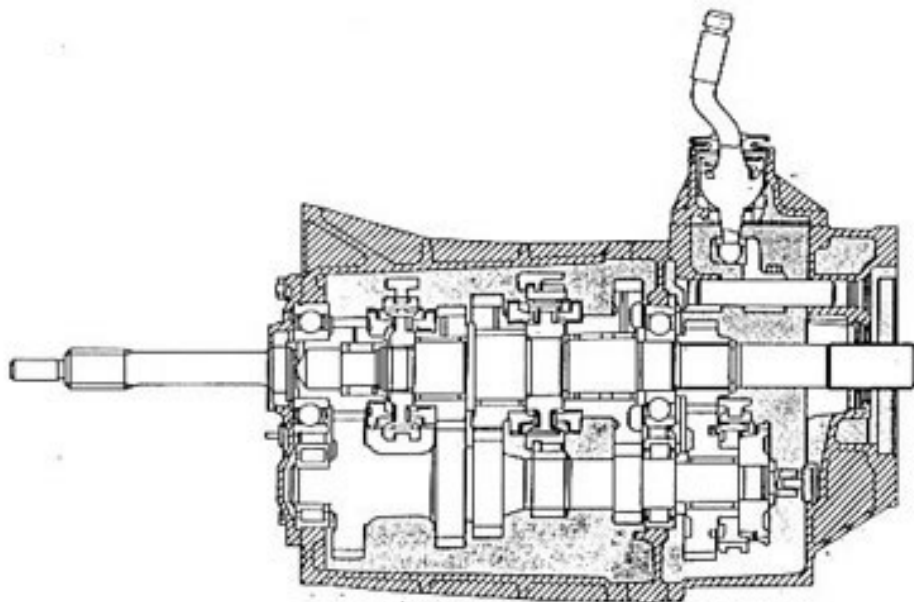


Fig. 1 AX 15 Manual Transmission

The first number is year of manufacture (e.g. 9 = 1989). The second and third numbers indicate month of manufacture (e.g. 01 = January, 10 = October, etc.). The next series of numbers is the transmission serial number.

### TRANSMISSION SHIFT PATTERN

The AX 15 shift pattern is shown in Figure 3. First and second and third and fourth gear ranges are in line for improved shifting. Fifth and reverse gear ranges are also in line at the extreme right of the pattern (Fig. 3).

The AX 15 is equipped with a reverse lockout mechanism. The shift lever must be moved through the Neutral detent before making a shift to reverse.

### TRANSMISSION LUBRICANT

#### Recommended Lubricant

Recommended lubricant for AX-5 transmissions is SAE 75W-90, API Grade GL-5 gear lubricant.

#### Lubricant Level

Correct lubricant refill or top-off level is to the bottom edge of the fill plug hole.

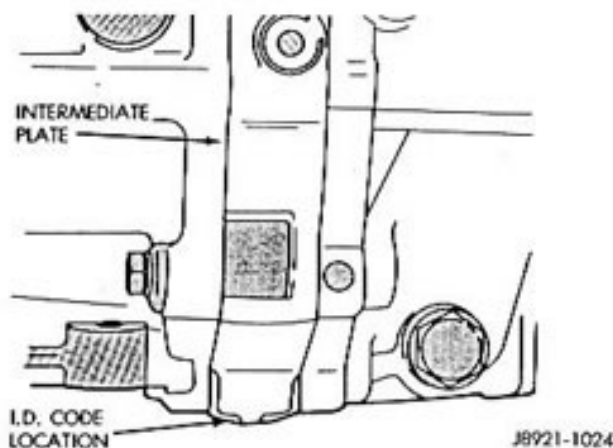
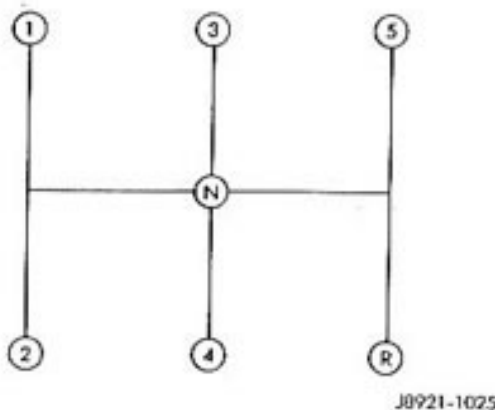


Fig. 2 Identification Code Number Location



### Lubricant Capacity

Lubricant capacity is as follows:

- 3.10 liters (3.27 U.S. quarts) for Cherokee, Wagoneer, Comanche, and Wrangler/YJ 4-wheel drive models.
- 3.15 liters (3.32 U.S. qts) for Cherokee, Wagoneer and Comanche 2-wheel drive models.

### TRANSMISSION SWITCH AND PLUG LOCATIONS

The fill plug is at the driver side of the gear case (Fig. 4).

The drain plug and backup light switch are on the passenger side of the gear case (Fig. 5).

### TRANSMISSION GEAR RATIOS

The transmission gear ratios are as follows:

- First gear - 3.83:1
- Second gear - 2.33:1
- Third gear - 1.43:1
- Fourth gear - 1.00:1
- Fifth gear - .789:1
- Reverse - 4.22:1

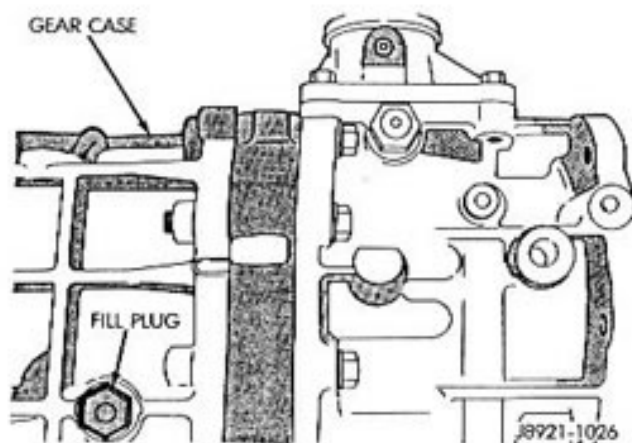
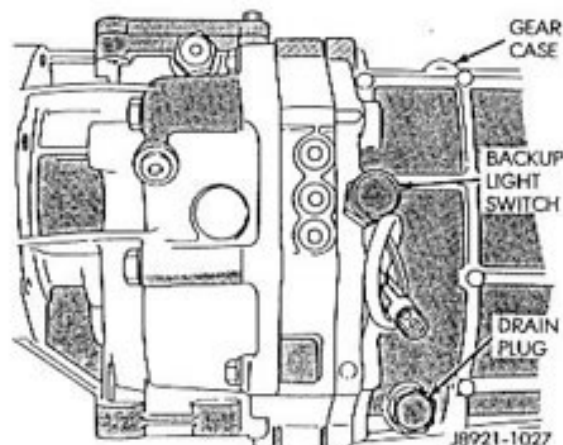


Fig. 4 Fill Plug Location



## SERVICE DIAGNOSIS

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## LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

Leaks can occur at the mating surfaces of the gear case, intermediate plate and adaptor or extension housing, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at the rear of the extension or adaptor housing will be from the housing oil seals. Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non-recommended sealer.

A leak at the front of the transmission will be from either the front bearing retainer or retainer seal. Lubricant may be seen dripping from the clutch housing after extended operation. If the leak is severe, it may also contaminate the clutch disc causing slip, grab and chatter.

Transmissions filled from air or electrically powered lubricant containers can be underfilled. This generally happens when the container delivery mechanism is improperly calibrated. Always check the lubricant level after filling to avoid an under fill condition.

A correct lubricant level check can only be made when the vehicle is level; use a drive-on hoist to ensure this. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an under-or-overfill condition.

## HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper or contaminated lubricants, component

damage, incorrect clutch adjustment, or by a damaged clutch pressure plate or disc.

Substantial lubricant leaks can result in gear, shift rail, synchro and bearing damage. If a leak goes undetected for an extended period, the first indications of the problem are usually hard shifting and noise.

Incorrect or contaminated lubricants can also contribute to hard shifting. The consequence of using non-recommended lubricants is noise, excessive wear, internal bind and hard shifting.

Improper clutch release is a frequent cause of hard shifting. Incorrect adjustment or a worn, damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts is the result.

Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases this condition will decline as the rings wear-in.

## TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears can generate a whine that may only be audible at extreme speeds.

Severe, obviously audible transmission noise is generally the result of a lubricant problem. Insufficient, improper, or contaminated lubricant can promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, also lead to gear breakage.

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**TRANSMISSION REMOVAL**

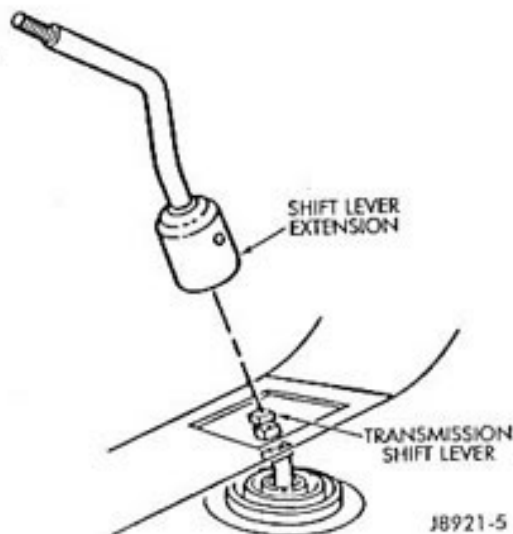
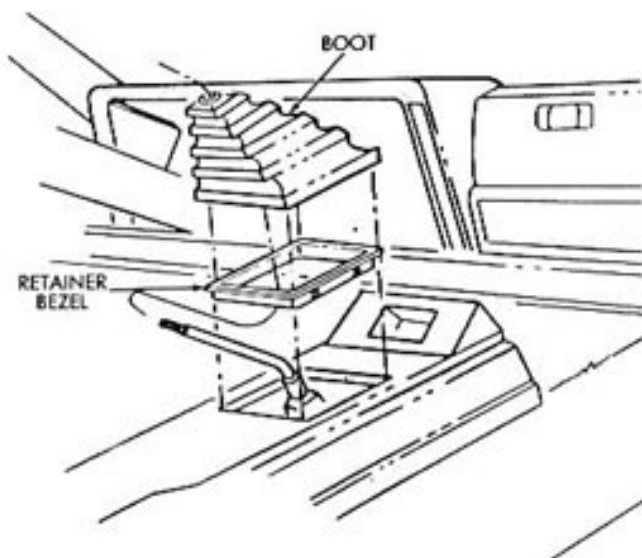
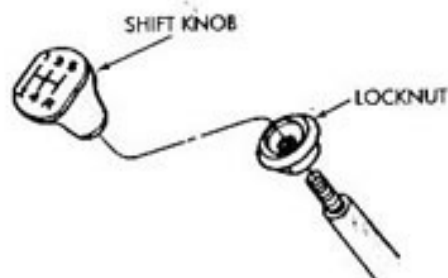
- (1) Remove the transmission shift knob, locknut, boot and shift lever extension (Fig. 1).
- (2) Unseat transmission shift tower dust boot (Fig. 2). Slide the boot up the lever for access to the retainer.
- (3) Press the shift lever retainer downward. Then turn the retainer counterclockwise to release it (Fig. 3).
- (4) Lift the shift lever up and out of the shift tower (Fig. 4).
- (5) Raise the vehicle.
- (6) Drain the transmission and transfer case lubricant.
- (7) Mark the rear propeller shaft for assembly reference (Fig. 5).
- (8) Disconnect and remove the rear propeller shaft.
- (9) Position a safety stand under the transfer case to support the transmission/transfer case assembly.
- (10) Remove the rear crossmember.
- (11) Disconnect the speedometer cable and remove the engine speed sensor.
- (12) Disconnect the backup light switch wire connector.
- (13) Disconnect the transfer case vent hose.
- (14) Disconnect the transfer case vacuum hoses and range linkage. Mark the vacuum hoses for reference.

- (15) Mark the front propeller shaft for alignment reference (Fig. 5) and remove the shaft.
- (16) Disconnect the clutch cylinder hydraulic line from the throwout bearing inlet line.
- (17) Place a transmission jack under the transmission/transfer case assembly. Then secure the assembly to the jack with safety chains.
- (18) Remove the clutch housing brace rod.
- (19) Remove the clutch housing-to-engine bolts and remove the transmission-transfer case assembly.
- (20) Remove the bolts attaching the transmission to the transfer case and separate the components.
- (21) Remove the hydraulic throwout bearing.
- (22) Remove the clutch housing from the transmission (Fig. 6).

**TRANSMISSION INSTALLATION**

- (1) Install the clutch housing on the transmission. Tighten the housing bolts to 27 ft-lbs (37 N·m) torque.
- (2) Install the throwout bearing.
- (3) Insert the shift lever into the shift tower and shift the transmission into any forward gear. Then remove the shift lever.





- (4) Mount the transmission on a jack. Raise the transmission and align the clutch housing with the engine.
- (5) Align the splines of the transmission input shaft with the clutch disc splines and seat the clutch housing on the engine.



Fig. 2 Unseating Shift Lever Dust Boot



Fig. 3 Disengaging/Engaging Shift Lever Retainer

(6) Install and tighten the clutch housing-to-engine bolts to 28 ft-lbs (38 N·m) torque.

(7) Connect the clutch cylinder line to the throwout bearing inlet line.

(8) Place a support stand under the clutch housing.

(9) Remove the jack used to support the transmission.

(10) Position the transfer case on the jack and raise the transfer case.

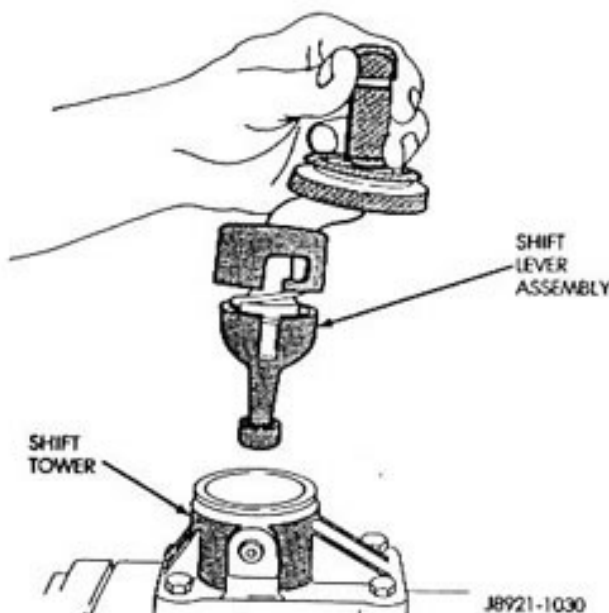


Fig. 4 Removing/Installing Shift Lever Assembly

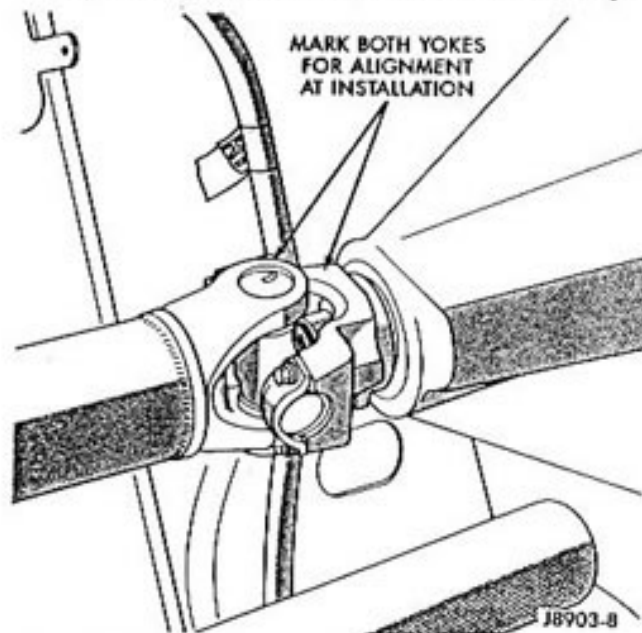


Fig. 5 Marking Propeller Shaft And Axle Yoke For

(11) Align and install the transfer case on the transmission.

(12) Tighten the transfer case-to-transmission nuts/bolts to 26 ft-lbs (35 N·m) torque.

(13) Remove the transmission jack and position a safety stand under the transfer case to support the assembly.

(14) Connect the transfer case vacuum hoses and shift linkage.

(15) Connect the transfer case vent hose.

(16) Connect the backup light switch wire connector.

(17) Connect the speedometer cable and install the engine speed sensor.

(18) Install the rear crossmember. Tighten the crossmember-to-frame bolts to 30 ft-lbs (41 N·m) torque.

(19) Tighten the transmission-to-rear support bolts/nuts to 33 ft-lbs (45 N·m) torque.

(20) Install the shift lever in the shift tower (Fig. 4).

(21) Seat the shift lever retainer and turn it clockwise to lock it in place (Fig. 3). Be sure the lever is fully seated in the shift arm inside the tower.

(22) Install the shift lever dust boot.

(23) Install the transmission and transfer case shift lever boots, shift knobs and locknuts.

(24) Align and install the front and rear propeller shafts. Tighten the shaft U-joint clamp bolts to 14 ft-lbs (19 N·m) torque.

(25) Fill the transmission with SAE 75W-90 gear lubricant.

(26) Fill the transfer case with Mopar Mercon™ or Dexron II™ transmission fluid.

(27) Lower the vehicle.

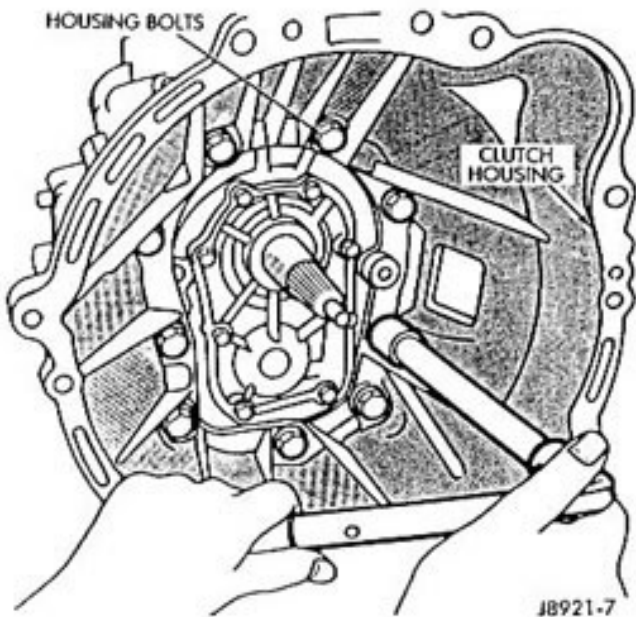


Fig. 6 Clutch Housing Removal/Installation



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## TRANSMISSION DISASSEMBLY

**Adapter/Extension Housing Removal**

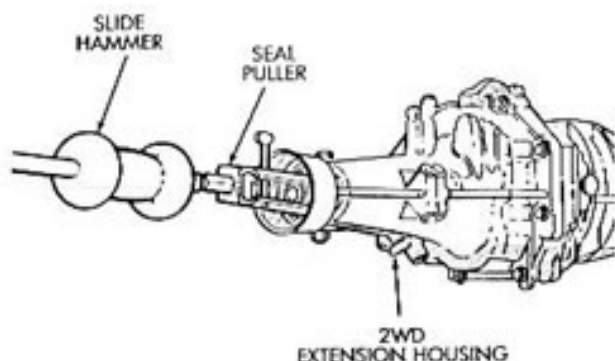
(1) Remove the hydraulic throwout bearing, clutch housing and shift lever if not previously removed.

(2) On 2-wheel drive models, remove the extension housing seal (Fig. 1).

(3) Remove the shift tower bolts and remove the tower from the adapter or extension housing (Fig. 2).

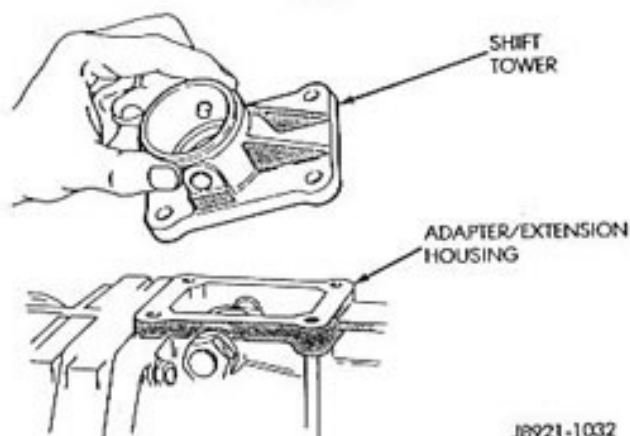
(4) Remove the gasket from the shift tower (Fig. 3).

(5) Remove the shift arm retainer bolt (Fig. 4).



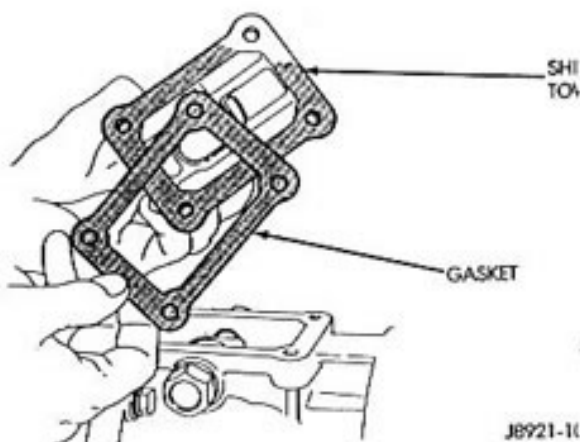
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Fig. 1 Removing 2-Wheel Drive Extension Housing Seal



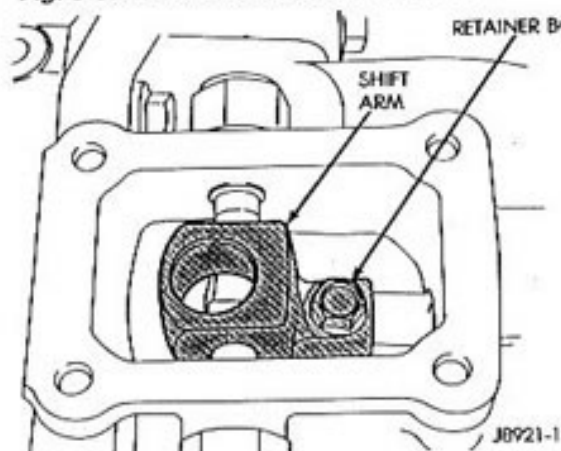
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Fig. 2 Shift Tower Removal/Installation



J8921-11

Fig. 3 Shift Tower Gasket Removal/Installation



J8921-1

Fig. 4 Shift Arm Retainer Bolt Removal/Installation

- (6) Loosen and remove the restrictor pins (Fig. 5).  
 (7) Remove the shift arm shaft plug (Fig. 6).  
 (8) Remove the shift arm shaft with a large magnet (Fig. 7).  
 (9) Remove the shift arm (Fig. 8).

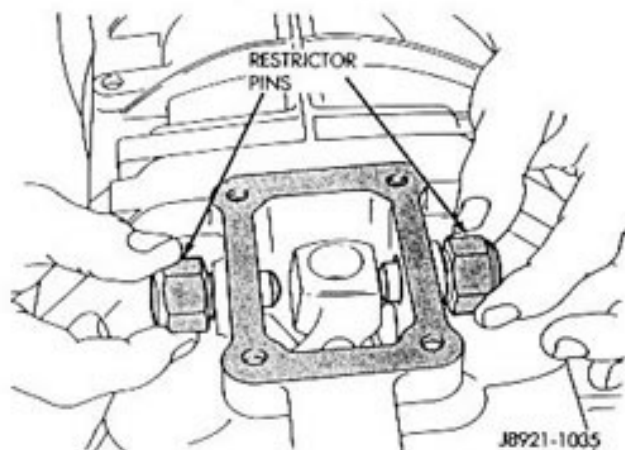


Fig. 5 Removing/Installing Restrictor Pins

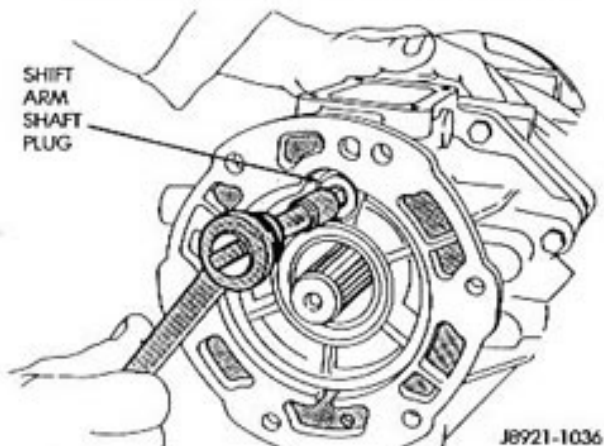


Fig. 6 Removing/Installing Shift Lever Shaft Plug

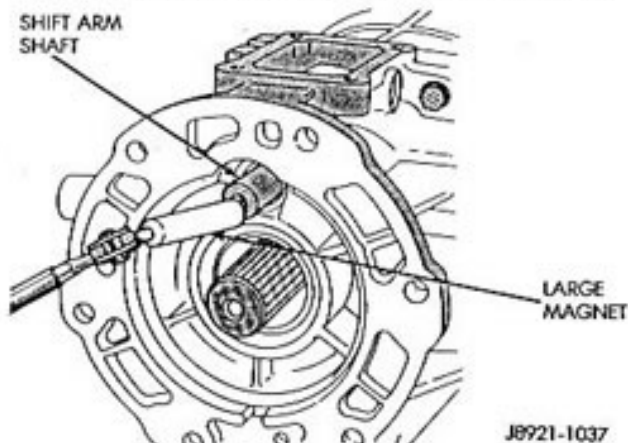


Fig. 7 Removing/Installing Shift Lever Shaft

- (10) Remove the plug for the reverse shift head lock ball. The plug is at the right side of the adapter housing near the backup light switch (Fig. 9).

- (11) Remove the lock ball spring with a pencil magnet (Fig. 10).

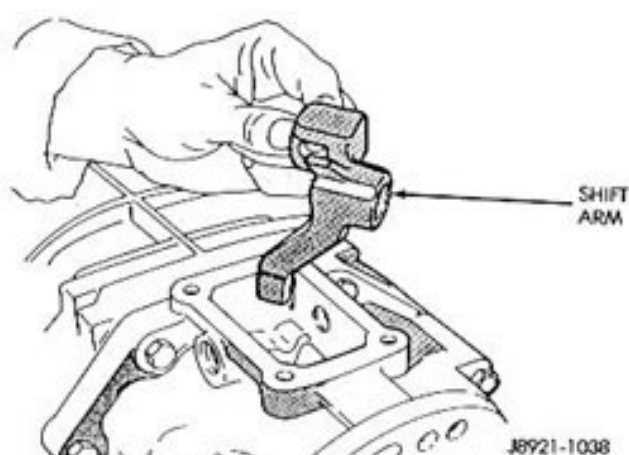


Fig. 8 Shift Arm Removal/Installation

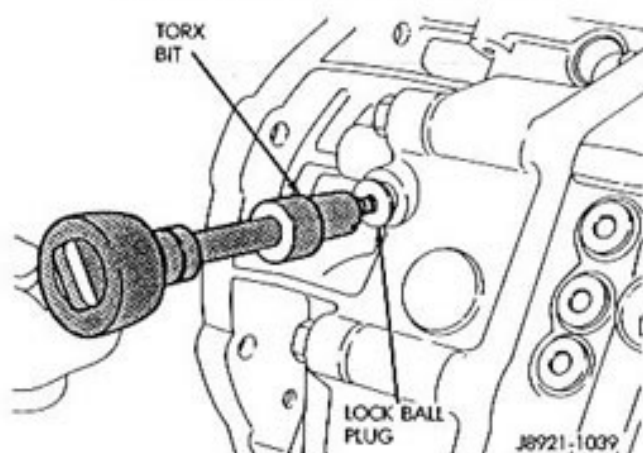


Fig. 9 Removing/Installing Lock Ball Plug

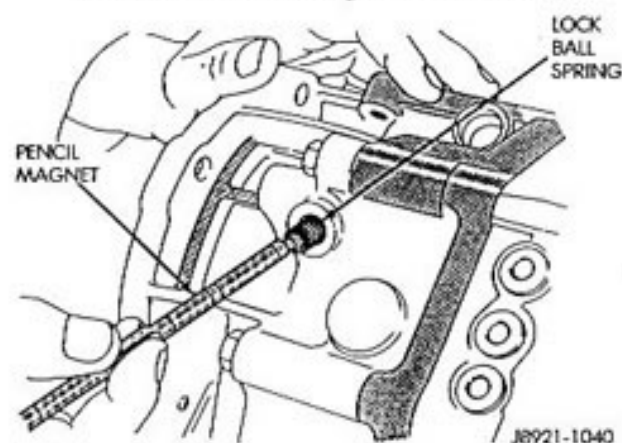


Fig. 10 Removing/Installing Lock Ball Spring

(12) Remove the shift head lock ball with a pencil magnet (Fig. 11).

(13) Remove the backup light switch from the adapter/extension housing.

(14) On 2-wheel drive models, remove the speedometer driven gear assembly if not removed previously.

(15) Remove the adapter/extension housing bolts (Fig. 12).

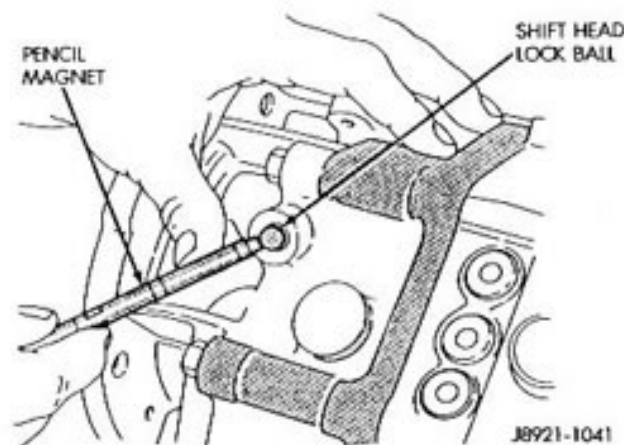


Fig. 11 Removing/Installing Shift Head Lock Ball

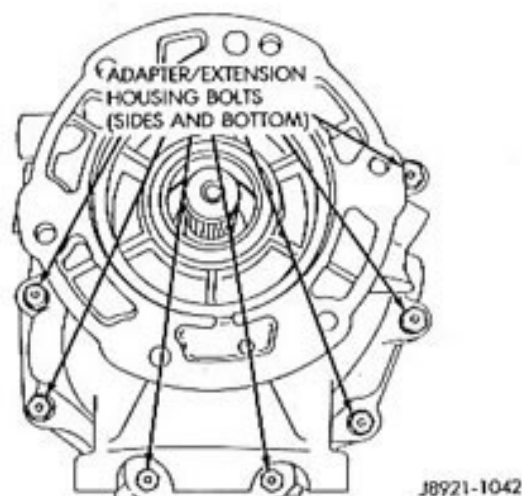
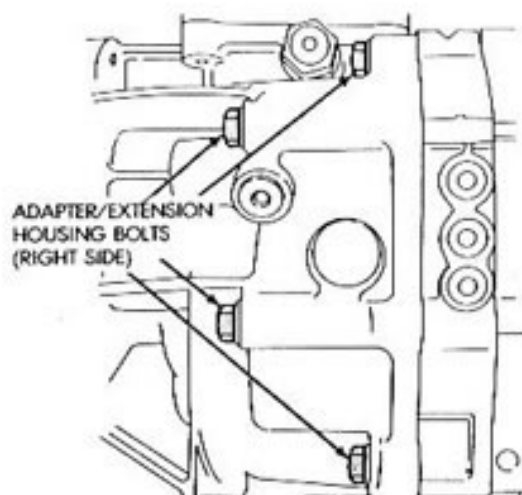
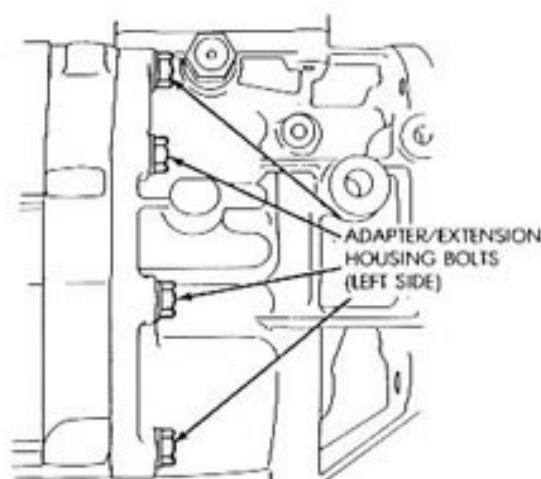


Fig. 12 Adapter Housing Bolt Locations

(16) Loosen the adapter/extension housing by tapping the housing with a rubber face mallet (Fig. 13).

(17) Remove the adapter housing after loosening it (Fig. 14)

(18) Remove the adapter housing oil seal with a pry tool (Fig. 15).

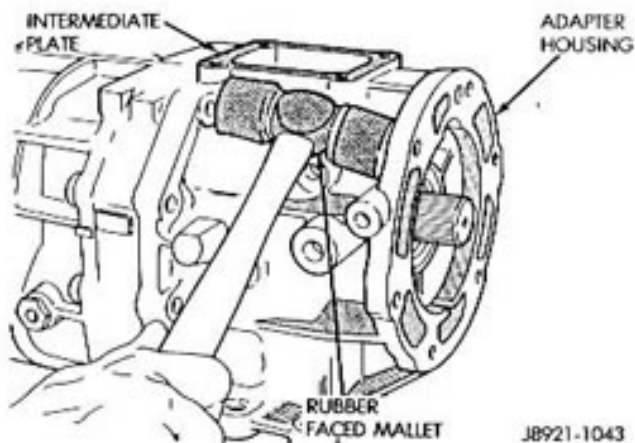


Fig. 13 Loosening Adapter Housing

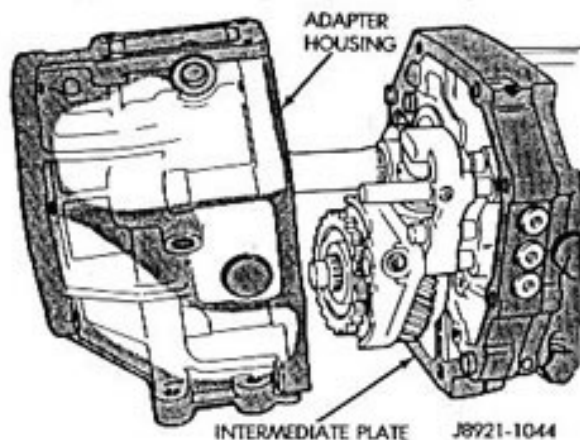


Fig. 14 Adapter Housing Removal

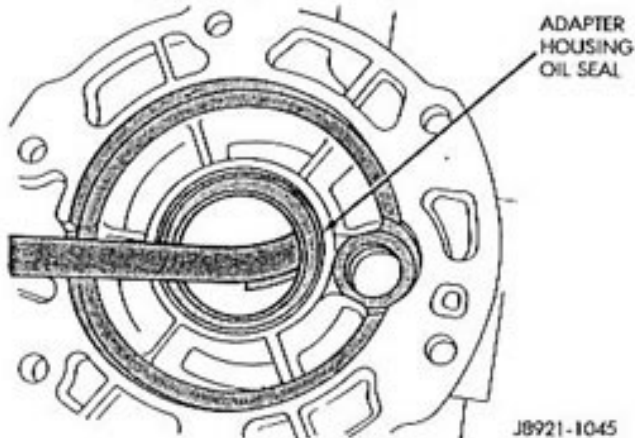


Fig. 15 Removing Adapter Housing Seal

### Gear Case Removal

(1) Remove the bearing retainer bolts and remove the retainer (Fig. 16).

(2) Remove the retainer oil seal with a pry tool (Fig. 17).

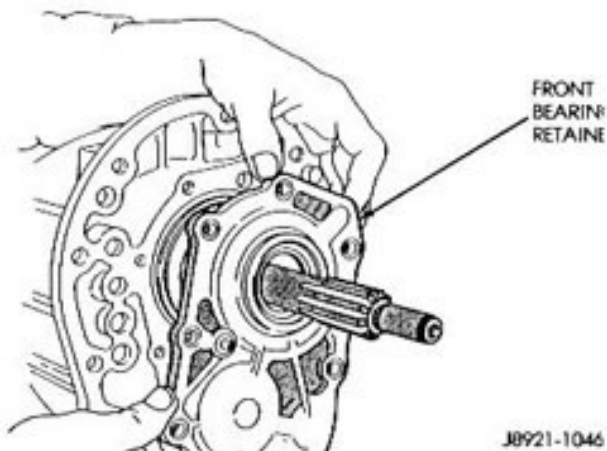


Fig. 16 Front Bearing Retainer Removal

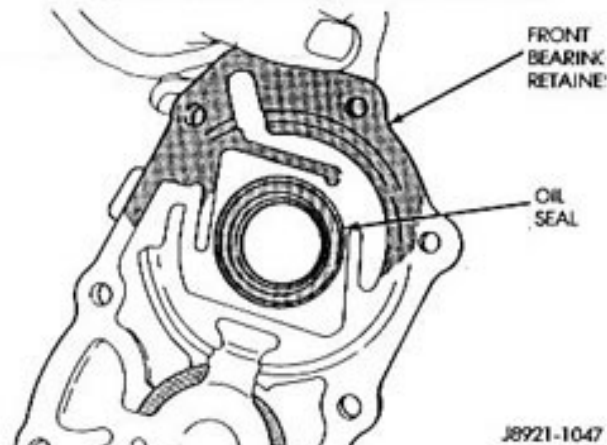


Fig. 17 Front Bearing Retainer Seal Location

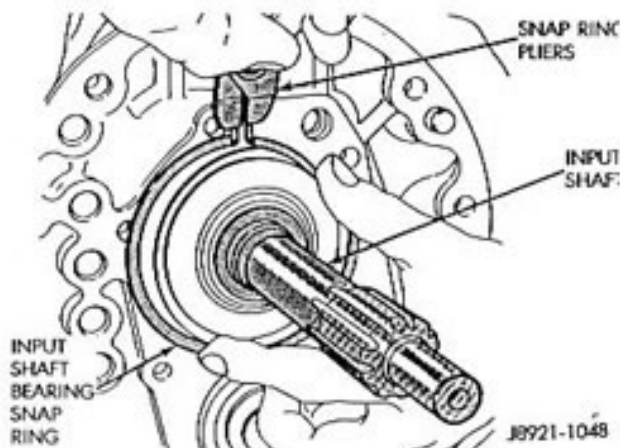


Fig. 18 Removing Input Shaft Bearing Snap Ring

- (3) Remove the input shaft bearing snap ring (Fig. 18).  
 (4) Remove the cluster gear front bearing snap ring (Fig. 19).

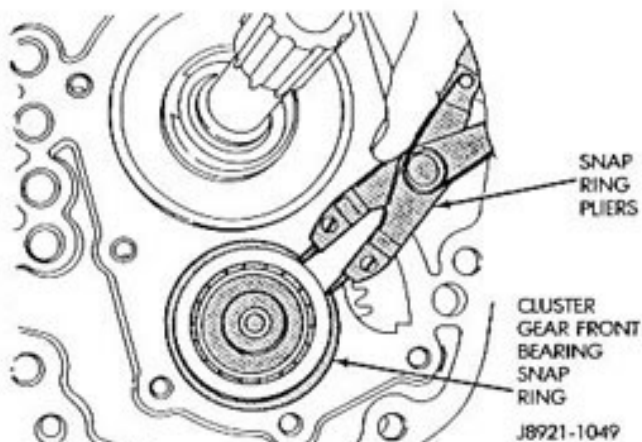


Fig. 19 Removing Cluster Gear Front Bearing Snap Ring

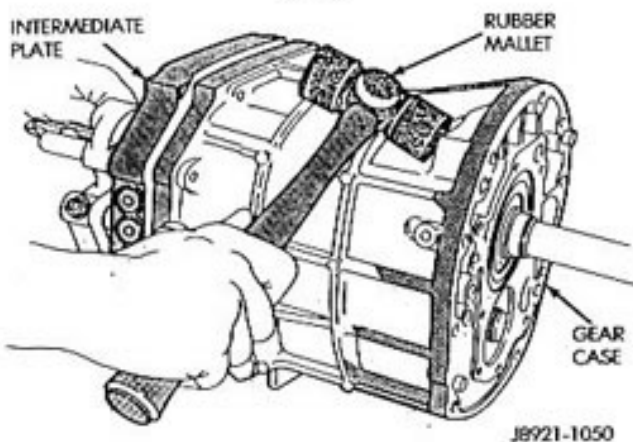


Fig. 20 Loosening Gear Case

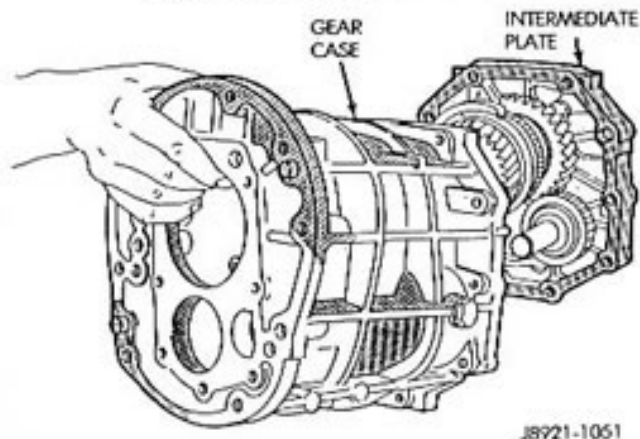


Fig. 21 Gear Case Removal

- (5) Loosen the gear case by tapping it away from the intermediate plate with a rubber mallet (Fig. 20).  
 (6) Remove the gear case from the geartrain and intermediate plate (Fig. 21).

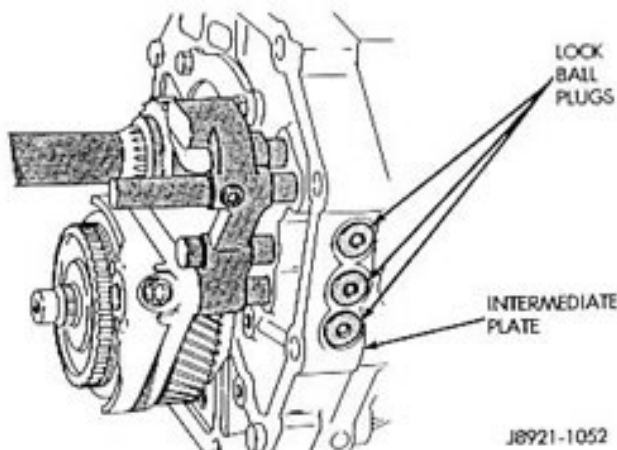


Fig. 22 Lock Ball Plug Locations

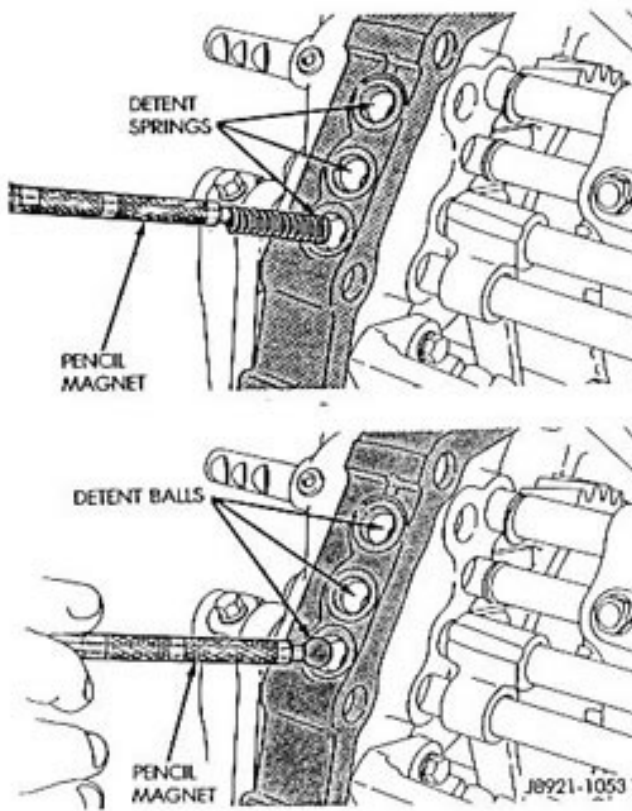
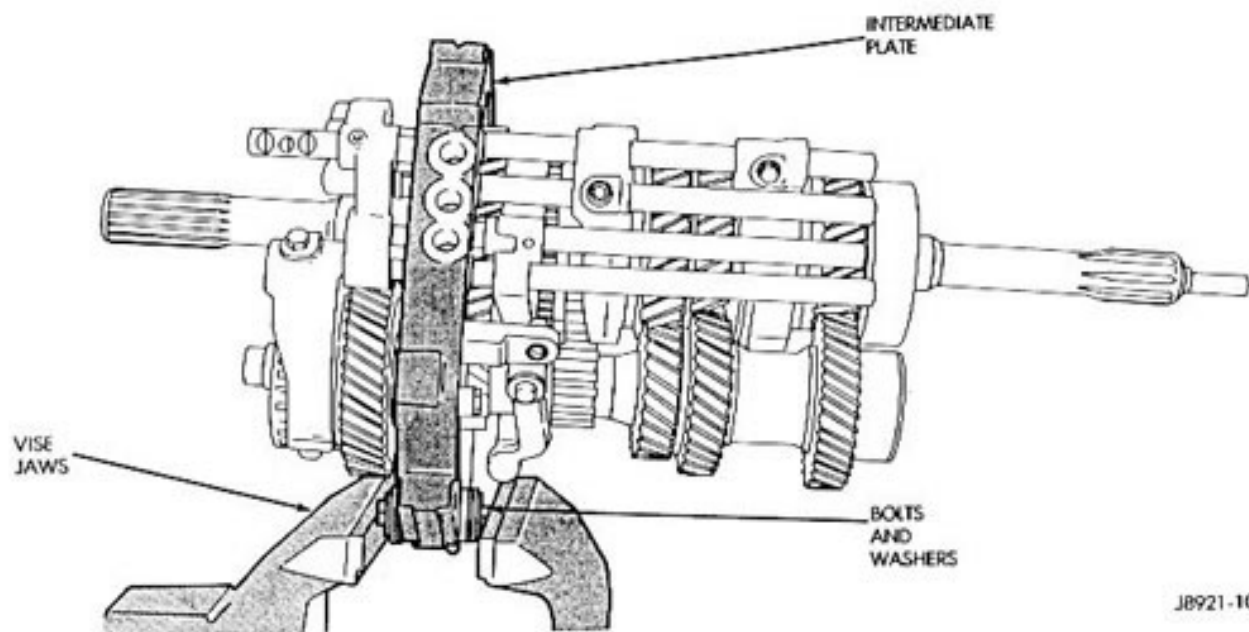


Fig. 23 Lock Ball And Spring Removal/Installation





JB921-1054

Fig. 24 Mounting Intermediate Plate And Geartrain In Vise

(7) On 2WD models, remove the speedometer gear snap ring and remove the speedometer gear and spacer from the output shaft.

#### **Fifth Gear And Synchro Assembly Removal**

(1) Remove the three lock ball plugs from the intermediate plate (Fig. 22).

(2) Remove the three lock ball springs and lock balls from the intermediate plate with a pencil magnet (Fig. 23).

(3) Mount the intermediate plate and geartrain as-

sembly in a vise as follows:

(a) Insert two spare bolts in one of the bottom bolt holes in the intermediate plate. Insert the bolts from the opposite sides of the plates (Fig. 24).

(b) Install enough flat washers under each bolt head to prevent the two bolts from touching (Fig. 24).

(c) Tape the bolts and washers in place and mount the intermediate plate in the vise (Fig. 24).

(d) Clamp the vise jaws securely against the bolt heads (Fig. 24). Do not clamp the vise jaws on the intermediate plate. Clamp only on the bolt heads.

(4) Remove the fifth gear snap ring (Fig. 25). Retain the snap ring for assembly reference. It is a select fit component.

(5) Remove the E-ring that secures the reverse shift arm to the fork (Fig. 26).

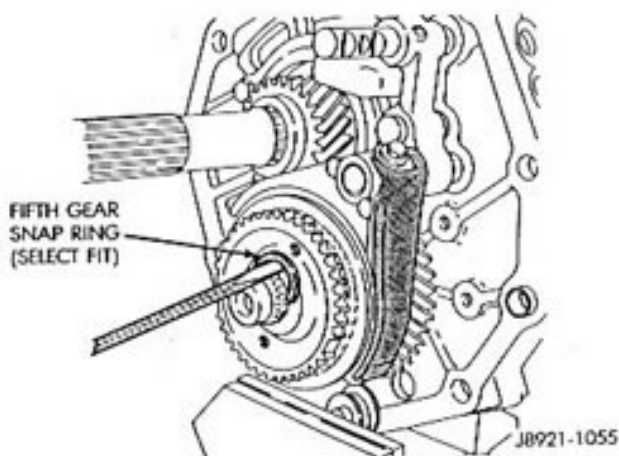


Fig. 25 Fifth Gear Snap Ring Removal

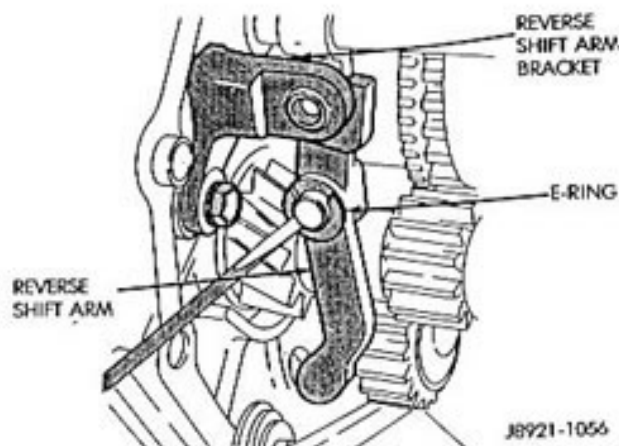


Fig. 26 Removing Reverse Shift Arm E-Ring



(6) Remove the bolts attaching the reverse shift arm bracket to the intermediate plate. Then remove the bracket (Fig. 27).

(7) Remove the reverse shift arm and shoe (Fig. 28).

(8) Remove the fifth gear shift fork set screw (Fig. 29).

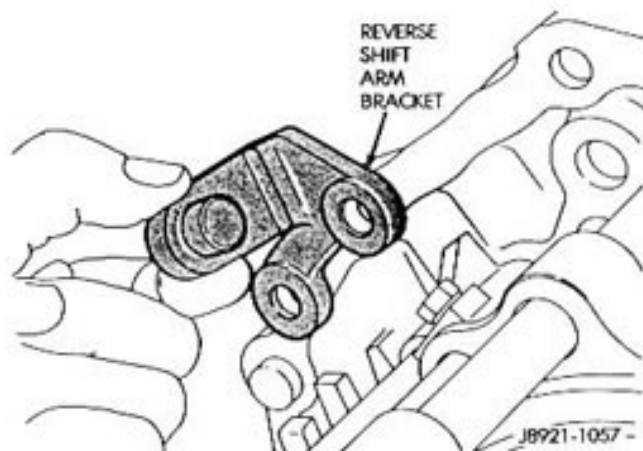


Fig. 27 Removing Reverse Shift Arm Bracket

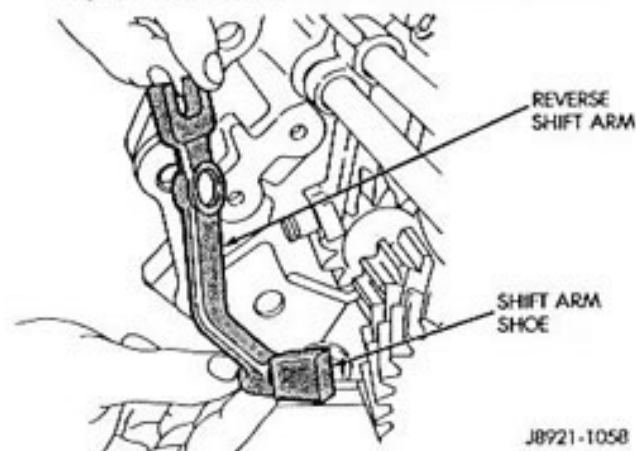
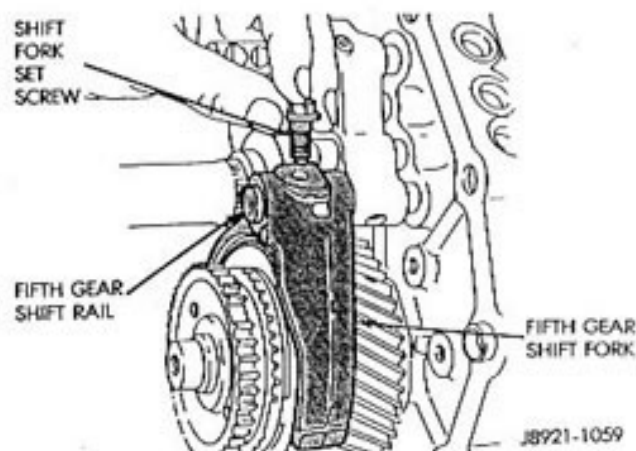


Fig. 28 Removing Reverse Shift Arm And Shoe



(9) Move the fifth gear shift rail forward until it clears the shift fork.

(10) Remove the fifth gear shift fork from the synchro sleeve (Fig. 30).

(11) Remove the reverse shift rail and the reverse

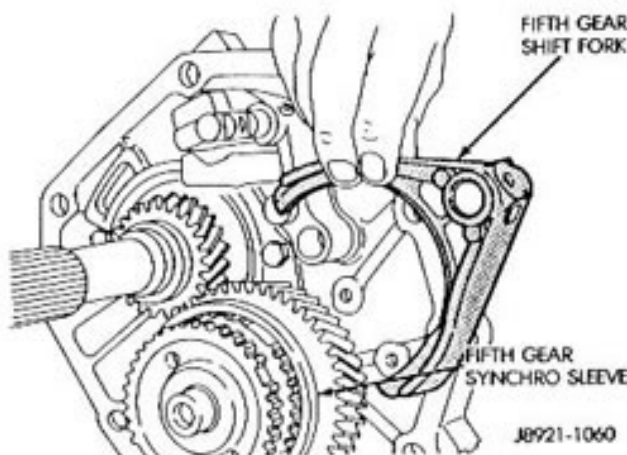


Fig. 30 Removing Fifth Gear Shift Fork

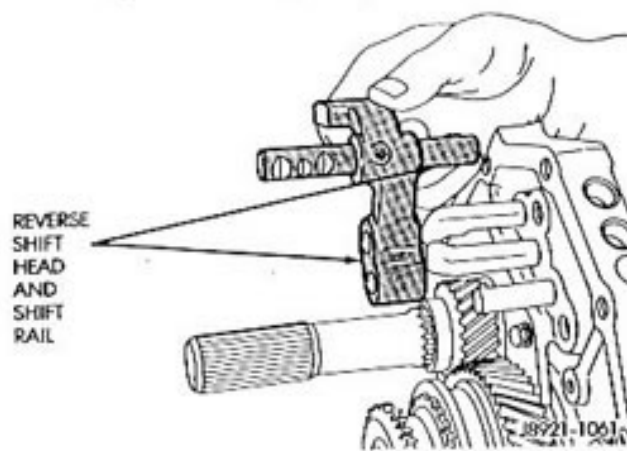
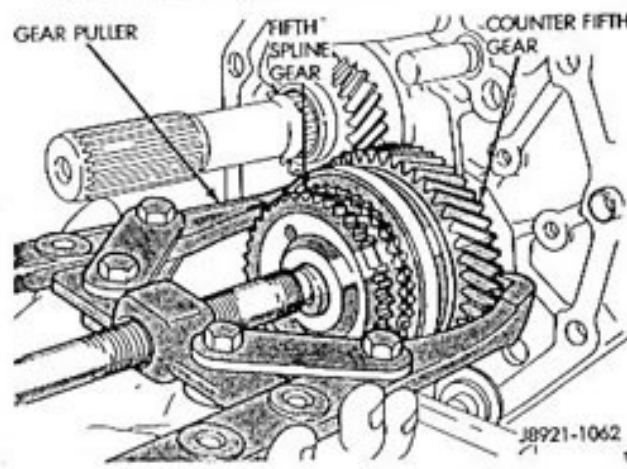


Fig. 31 Removing Reverse Shift Head And Rail



shift head as an assembly (Fig. 31).

(12) Measure thrust clearance between the counter fifth gear and the thrust ring with a feeler gauge. Clear-

ance should be .10 to .40 mm (.003 to .0197 in). If clearance exceeds limits, the gear and/or ring will have to be replaced.

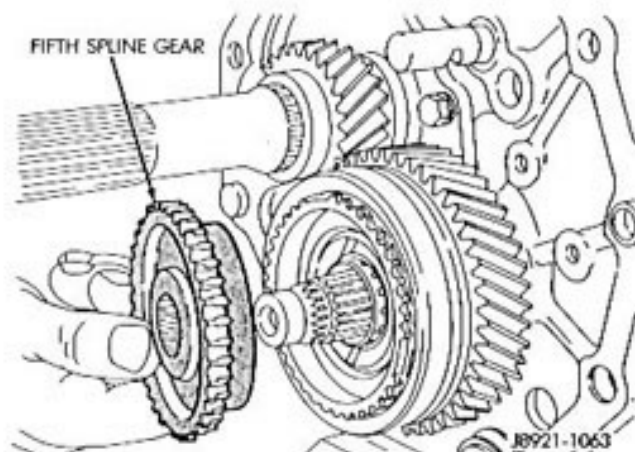


Fig. 33 Removing Fifth Spline Gear

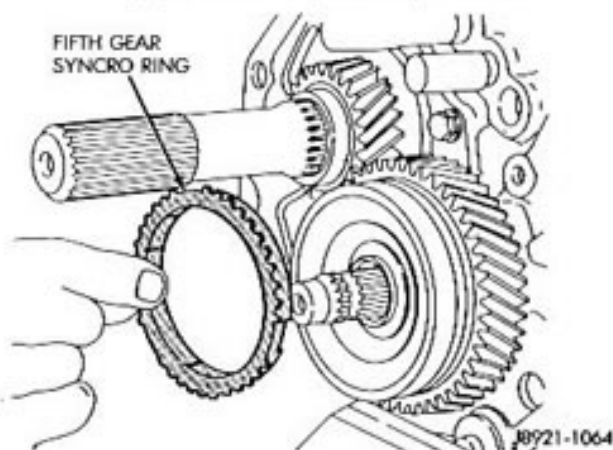


Fig. 34 Removing Fifth Gear Synchro Ring

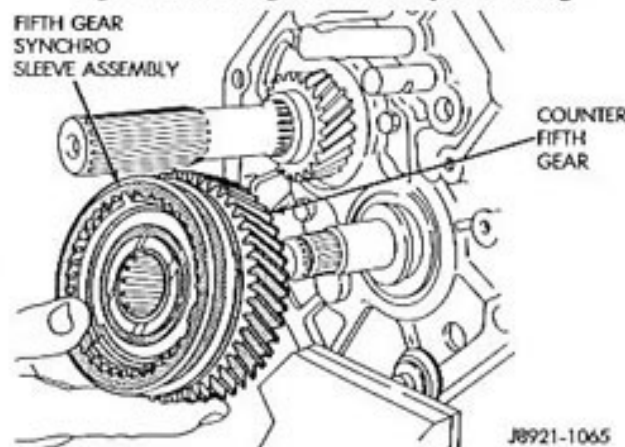


Fig. 35 Removing Counter Fifth Gear And Synchro Assembly

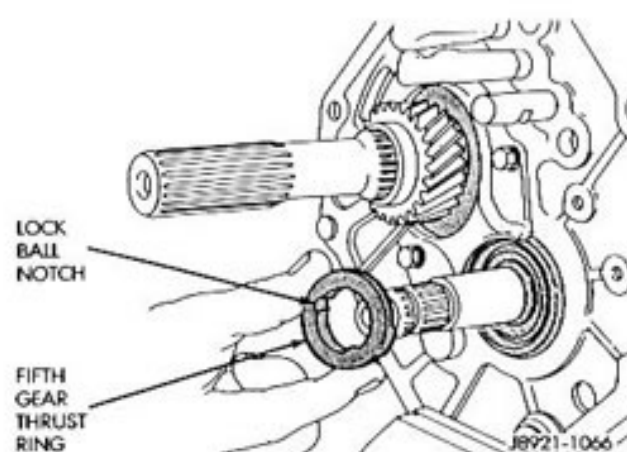


Fig. 36 Removing Fifth Gear Thrust Ring

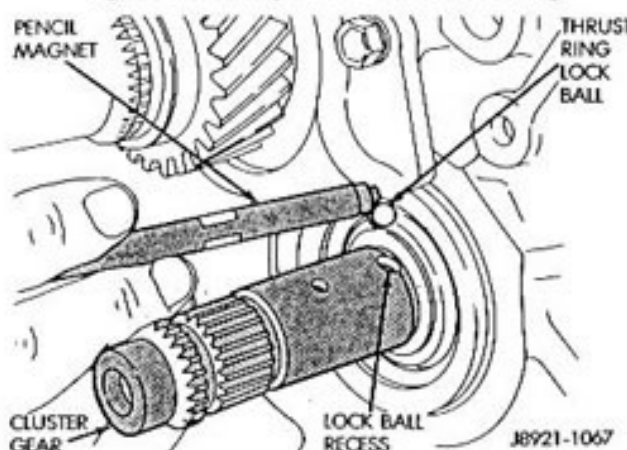


Fig. 37 Removing Thrust Ring Lock Ball

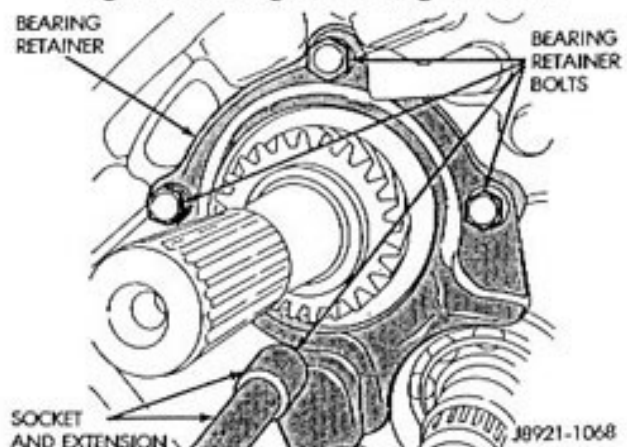


Fig. 38 Removing Output Shaft Rear Bearing Retainer Bolts

(13) Loosen the fifth spline gear with a standard two-jaw puller (Fig. 32). Position the puller jaws behind the fifth counter gear as shown.

(14) Remove the fifth spline gear (Fig. 33).

(15) Remove the fifth gear synchro ring (Fig. 34).

(16) Remove the fifth gear synchro and sleeve assembly (Fig. 35).

(17) Remove the counter fifth gear thrust ring (Fig. 36).

(18) Remove the thrust ring lock ball with a pencil magnet (Fig. 37).

(19) Remove the bolts attaching the output shaft rear bearing retainer to the intermediate plate (Fig. 38).

(20) Remove the rear bearing retainer (Fig. 39).

(21) Remove the reverse gear and shaft (Fig. 40).

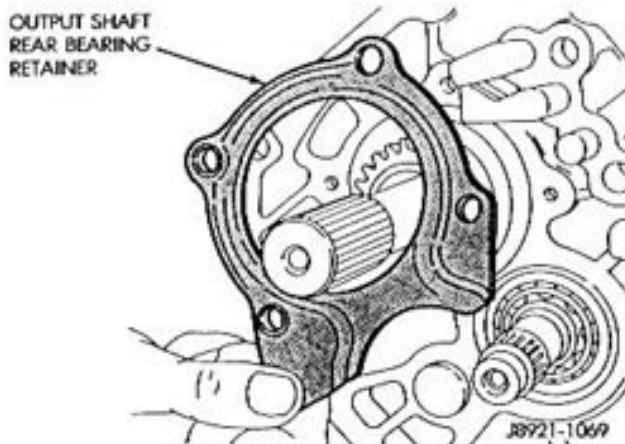


Fig. 39 Removing Output Shaft Rear Bearing Retainer

### Shift Rail And Fork Removal

There are a total of five shift rails in the AX 15 transmission. The 1-2, 3-4, fifth gear and front reverse shift rails are shown in Figure 41. Two shift rails are used for reverse gear range. The front reverse rail is at the forward side of the intermediate plate (Fig. 41). The short rear reverse rail and reverse shift head are at the rear side of the intermediate plate.

It is not necessary to remove the shift rails if they do not require service during overhaul. Only the shift forks need be removed for access to the shafts and gears.

(1) Remove the fifth gear shift rail (Fig. 41). Catch the lock ball in your hand as the rail comes out of the intermediate plate.

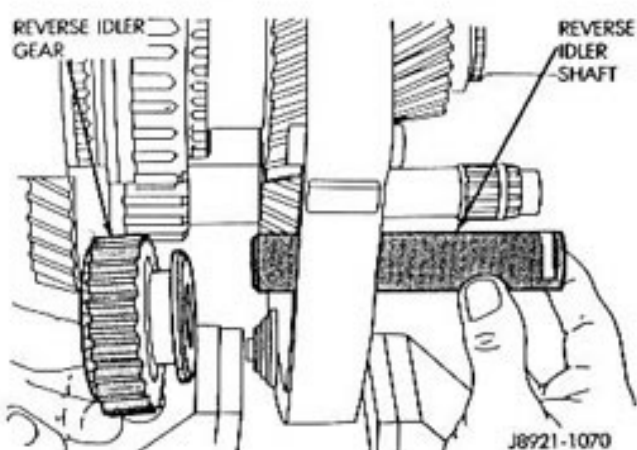


Fig. 40 Removing Reverse Idler Gear And Shaft

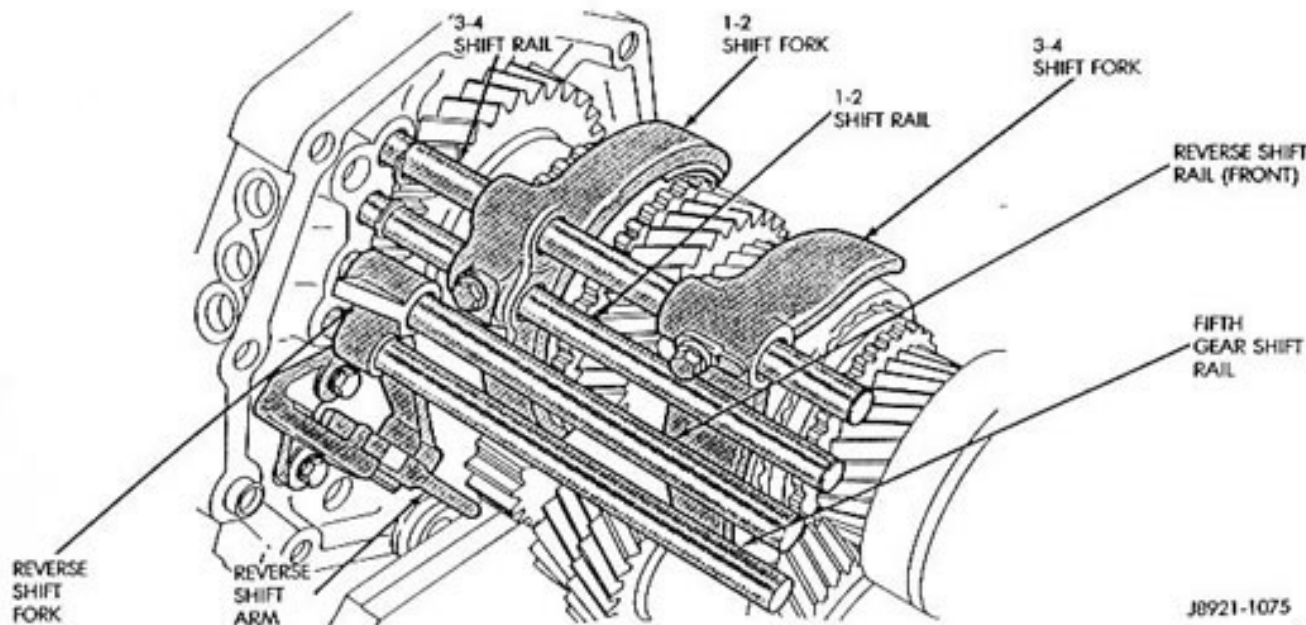


Fig. 41 Shift Rail Identification

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(2) Remove the 1-2 and 3-4 shift rail C-rings with two screwdrivers of equal size and length (Fig. 42).

(3) Remove the shift fork set screws (Fig. 43).

(4) Remove the 3-4 shift rail from the shift fork and intermediate plate (Fig. 44).

(5) Remove the 3-4 shift rail interlock plug from the intermediate plate with a magnet (Fig. 45).

(6) Remove the 1-2 shift rail from the shift fork and intermediate plate (Fig. 46).

(7) Remove the 1-2 shift rail interlock pin from the shift rail (Fig. 47).

(8) Remove the 1-2 shift rail interlock plug from the intermediate plate (Fig. 48).

(9) Lift the reverse shift fork upward and remove the

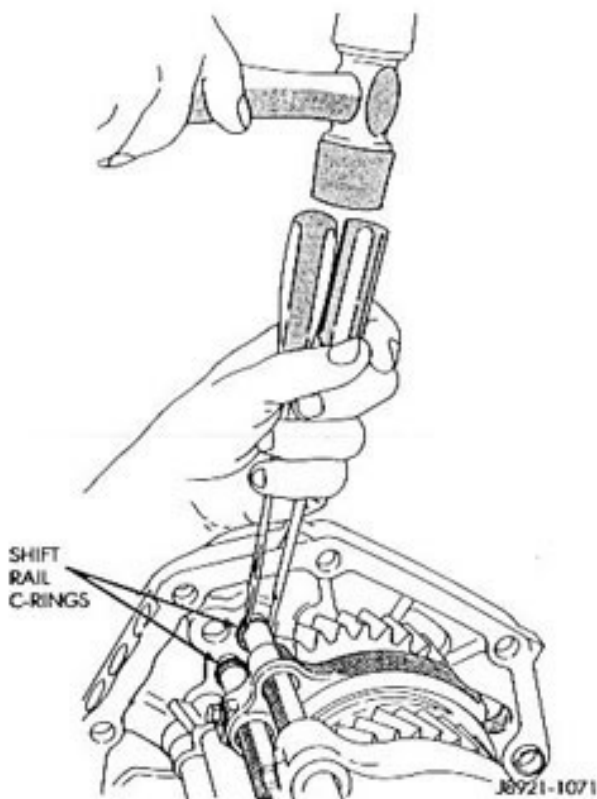


Fig. 42 Removing Shift Rail C-Rings

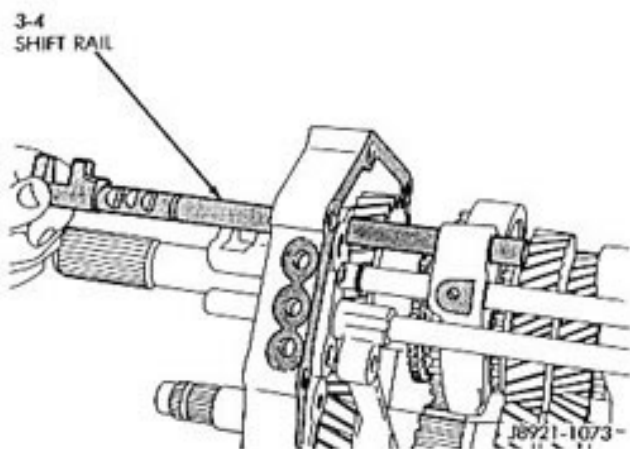


Fig. 44 Removing 3-4 Shift Rail

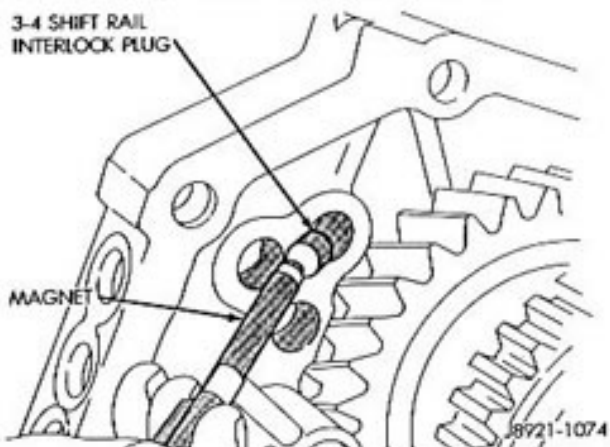


Fig. 45 Removing 3-4 Shift Rail Interlock Plug

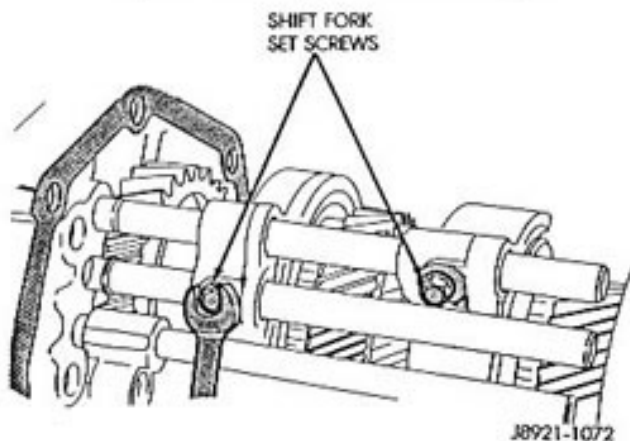


Fig. 43 Removing Shift Fork Set Screws

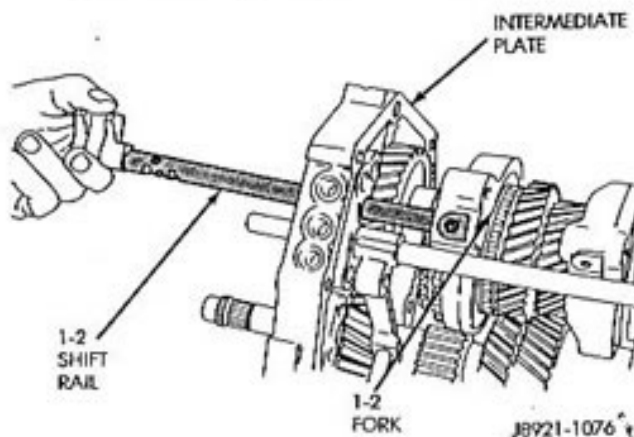


Fig. 46 Removing 1-2 Shift Rail